REPORT NO. 4

INDO-POLISH INDUSTRIAL FISHERIES SURVEY ALONG THE NORTH WEST COAST OF INDIA

PRELIMINARY REPORT OF THE FOURTH CRUISE OF M. T. MURENA FOR THE PERIOD FROM 15th JUNE TO 22nd AUGUST 1977

EXPLORATORY FISHERIES PROJECT
(MINISTRY OF AGRICULTURE AND IRRIGATION)
GOVT. OF INDIA
BOMBAY.

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Preliminary report of the fourth cruise of M.T. Murena for the period from 15-6-77 to 22-8-77

By

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OCTOBER, 1977

EXPLORATORY FISHERIES PROJECT
GOVERNMENT OF INDIA
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FISH TECHNOLOGY EXPERIMENT STATION
C.F.T.R.I.
MANGALORE.

PARTICIPANTS, PARTICIPATING AGENCIES AND VESSELS DEPLOYED

Participants	Participating agencies
M.T. MURENA	
4th Cruise from 15-6-77 to 22-8-77	
CAPTAIN	
1. Mr. Dziewiecki Wladystaw	Master, M.T. Murena
SCIENTISTS	
1. Mr. Zaczek Krsysztof	Deputy Master and Ichthyologist, M.T.Murena
2. Mr. Tadeuss Chromics	Oceanographer, M.T.Murena
3. Shri T.E. Sivaprakasam	Deputy Director, Exploratory Fisheries Project, Port Blair from 14-6-77 to 22-6-77
4. Prof. Y. Sreekrishna	Professor, Central Institute of Fisheries Education, Bombay from 28-6-77 to 22-8-77
5. Shri K. Rangarajan	Scientist, Central Marine Fisheries Research Institute, Bombay from 14-6-77 to 5-7-77
6. Shri C.Muthiah	Scientist, Central Marine Fisheries Research Institute, Bombay from 22-7-77 to 22-8-77
7. Shri T.G.K.Murthy	Oceanographer, Naval Physical Oceanographic Laboratory, Cochin
FISHING TECHNICIANS	
1. Shri V.G. Tandel	Skipper, Directorate of Fisheries, Government of Gujarat, Porbandar
2. Shri I. Prasad	Bosun, Central Institute of Fisheries Nautical & Engineering Training, Madras
3. Shri P.V.Rajan	Bosun, Exploratory Fisheries Project, Cochin
4. Shri J. Mondel	Cook, Exploratory Fisheries Project, Bombay from 14-6-77 to 28-6-77
5. Shri A.I. Mujawar	Cook, Exploratory Fisheries Project, Bombay from 28-6-77 to 22-8-77

ADVISORY COMMITTEE ON INDO-POLISH FISHERIES RESOURCES SURVEY OF THE NORTH WEST COAST OF INDIA (MINISTRY'S REF. NO. 46-15/73-FY(B&A)/T-1 DATED 6TH MAY, 1977)

1.	Smt. S.L. Singla, Joint Secretary(Fisheries), Department of Agriculture, New Delhi	CHAIRMAN
2.	Director, Integrated Finance, Ministry of Finance, New Delhi	MEMBER
3.	Joint Commissioner(Fisheries), Department of Agriculture, New Delhi	MEMBER
4.	Secretary, Forest and Fisheries Department, Government of Maharashtra, Bombay	MEMBER
5.	Secretary, Agriculture and Co-operation Department, Government of Gujarat, Ahmedabad	MEMBER
6.	Director, Central Marine Fisheries Research Institute, Vincent Road, Cochin	MEMBER
7.	Director, Central Institute of Fisheries Nautical and Engineering Training, Cochin	MEMBER
8.	Director, Central Institute of Fisheries Education, Versova, Bombay	MEMBER
9.	Nominee of Bombay Port Trust, Bombay	MEMBER
10.	Nominee of the Ministry of Defence, New Delhi	MEMBER
11.	Director, Exploratory Fisheries Project, Bombay	MEMBER/CONVENOR

A C K N O W L E D G E M E N T S

In pursuance of the agreement signed at Warsaw on 26th August, 1976 between the Ministry of Foreign Trade and Shipping (Polish People's Republic) and the Ministry of Agriculture and Irrigation (Government of India) the Indo-Polish Industrial Fisheries Survey along the North west coast of India was started from January, 1977. The present report, the fourth in the series embodies the preliminary results of investigations carried out by M.T.Murena during the fourth voyage from 15th June to 22nd August, 1977.

We express our sincere thanks to Shri G.V.K. Rao, Secretary, Smt. Anna Malhotra, Additional Secretary, Smt. S.L. Singla, Joint Secretary (Fisheries), Ministry of Agriculture and Irrigation, Government of India for providing guidelines and facilities for this programme. Professor P.C.George, Joint Commissioner (Fisheries) and Shri J.V.H. Dixitulu, Deputy Commissioner (ET) have taken active interest and provided valuable support and guidance throughout the investigation.

The consul of the Polish People's Republic Mr. Edmund Kaczmarek and his associates including Mr. Dziewiecki Wladystaw Master of M.T.Murena along with his colleagues extended whole hearted support and we wish to thank them for this valuable assistance and co-operation.

We are thankful to Dr. S.N. Dwivedi, Director, Central Institute of Fisheries Education, Versova for his encouragement and valuable guidance since the inception of the Indo-Polish programme along the North west coast of India. We are also thankful to Shri D.A.S. Gnanadoss, Director, Central Institute of Fisheries Nautical and Engineering Training, Cochin, Dr. E.G.Silas, Director, Central Marine Fisheries Research Institute, Cochin and Dr. D.Sreenivasan, Director, Naval Physical Oceanographic Laboratory, Cochin and their colleagues for their valuable support and participation.

The active participation of Sarvashri Zaucek

M.Sysoi, Tadeuss Chromics, T.E.Sivaprakasam, Y.Sreekrishna, K.Rangarajan, C.Muthiah and T.G.K.Murthy have been extremely valuable for the successful completion of the entire voyage. Due to his sudden illness while on board, Shri T.E.Sivaprakasam had to be hospitalised on shore and his place was taken up by Professor Y.Sreekrishna of Central Institute of Fisheries Education, Bombay. Shri K.Rangarajan, Scientist from Central Marine Fisheries Research Institute was also replaced by Shri Muthiah, another Scientist from the same organization. The ready response given by Professor Y. Sreekrishna and Shri C. Muthiah for participation in the voyage at such short notice deserves special mention and we take this opportunity of expressing our thanks to them.

The data relating to hydrography and meteorology presented in this report is based on the short resume submitted by the Oceanographers on board who had participated in the voyage and we are thankful to them.

Special thanks are extended to Shri S.K. Bhadury, Executive Engineer, Exploratory Fisheries Project for all the timely help given and for the keen interest he has evinced during the different stages of the programme. Further, the authors wish to acknowledge the encouragement given by him at all times in the preparation of this report. During the different stages of the programme association of Dr. S.V.Bapat, Officer-in-charge, Bombay Research Centre of the Central Marine Fisheries Research Institute, Bombay had been most valuable.

We thank Smt. S.L. Singla, Joint Secretary (Fisheries) and the Chairman of the Advisory Committee on Indo-Polish Fisheries Resources Survey on the North west coast of India and all other members of the Advisory Committee for their valuable guidance. We wish to thank Shri A.G.Kalawar, Director of Fisheries, Government of Maharashtra for his valuable suggestions and advice at the post and pre-cruise meetings and in the finalisation of the cruise programmes.

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INTRODUCTION

Since January, 1977 the Polish vessel M.T. Murena has undertaken four voyages as part of the Industrial Fisheries Survey Programme along the North west coast of India, envisaged under the Indo-Polish agreement signed between the two governments on 26th August, 1976. The results of operation of the first, second and third voyages have been published in the form of preliminary reports by the Exploratory Fisheries Project during April, May and August, 1977 respectively. The present report is the fourth in the series embodying the results of investigations carried out by M.T. Murena during her fourth voyage from 15-6-77 to 22-8-77. Due to the defects noticed in Decca Navigator, the vessel had to return to the port by 22-6-77 and after repairs proceeded again on 28-6-77. Due to the breakdown of electrical motor, the vessel had to return again to Bombay on 4-7-77 and the vessel remained in port till 23-7-77. After completing the programme, the vessel returned to the port on 22-8-77. During the cruise, pelagic/mid-water trawl was used exclusively. The nature and magnitude of the pelagic and columnar resources in the area of investigation along the North west coast of India ~~was~~ were investigated in detail and the data collected has been examined in the light of the earlier findings in respect of the voyages undertaken. It is hoped that this will enable to have a critical analysis about the area-wise distribution as well as the seasonal abundance of the stock available from 30 to 200 fathoms along the North west coast.

2. VESSEL AND GEAR

The specification of the survey vessel M.T.Murena and the design of the pelagic trawl operated have been presented in

Report Nos. 1 and 3 respectively. Ancillary vessels were not available for operation during the fourth cruise of M.T.Murena.

3. PROGRAMME OF WORK OF THE MAIN SURVEY VESSEL

The programme of work for the fourth cruise was that the vessel would undertake pelagic survey along the North west coast of India from 15° N to 24° N latitude in the depth ranges from 30 - 200 fathoms taking a "Zig-zag" course as shown in the chart given elsewhere, making 40 obligatory hauls, a minimum of four hauls in each zone. For the entire cruise commencing from 15th June, 1977, besides 40 obligatory hauls, about 80 extra hauls were envisaged depending on the location of fish schools. Besides the fishing programme, it was programmed to take Oceanographic parameters like hydrocast, bathythermograph cast and plankton collections at standard stations.

There were not much of a variation in the execution of the programme, except for the slight alterations in the dates for the commencement and conclusion of the cruise as was necessitated by major breakdowns and repairs to the main engine of the vessel. Though the vessel had to return to the base twice to attend to the repairs at port she conducted 43 days of actual fishing in the course of investigation.

4. METHODS OF OPERATION

Methodology followed for the pelagic fish survey programme as well as for the collection of environmental data has been discussed in detail in the earlier reports of the series. A 64/108 metre standard pelagic rope trawl, a standard type of gear for this class of vessel in Poland, was used during the entire cruise in combination with "Suberkrub" otter boards and double sweeps of 70 m length each. Mention may be made here that the net used had a vertical opening of about 15 metres. During the present cruise also the composition of species in each haul was studied in detail and biological

observations such as length frequency measurements, sex ratio and maturity studies were also taken. Gut contents and otoliths/scales of commercially important species were collected for later analysis in the shore laboratory. Plankton samples were collected at selected stations using the standard Indian Ocean Plankton net. Oceanographic data pertaining to temperature, salinity and dissolved oxygen at surface and bottom layers as well as at the fishing depths were also collected by the Oceanographic team on board the vessel. 30 KHz frequency echo sounder and 31 KHz Sonar were used throughout the voyage besides netzonde at the time of operation. Echo papers were collected for detailed observations in the laboratory ashore.

5. EXTENT OF DATA COLLECTED

As outlined in the programme, the zig-zag pattern was followed for pelagic survey. It was also made clear that during the return journey from southern and northern sectors the track may be made intercepting the points, the extreme points on 30 and 200 fathom line should generally lie equidistant between the two points marked in the map shown elsewhere. Fig. 1 shows the cruise track followed by M.T.Murena during her fourth cruise.

A total of 127 trawl stations were made during this cruise, spread over in the 10 zones into which the survey area was divided for pelagic survey (Fig.2). This included 40 obligatory hauls and 87 extra hauls distributed in the different zones. The distribution of trawl stations worked in the 10 zones under review is furnished in Table No. I which shows that 117 hauls were made for exploratory pelagic survey while 10 hauls were aimed at intensive exploration in comparatively good grounds located. The location of pelagic trawl stations worked by M.T.Murena is given in Fig.3.

FIG. 1. CRUISE TRACK – CRUISE NO. 4 M.V. MIRISHA

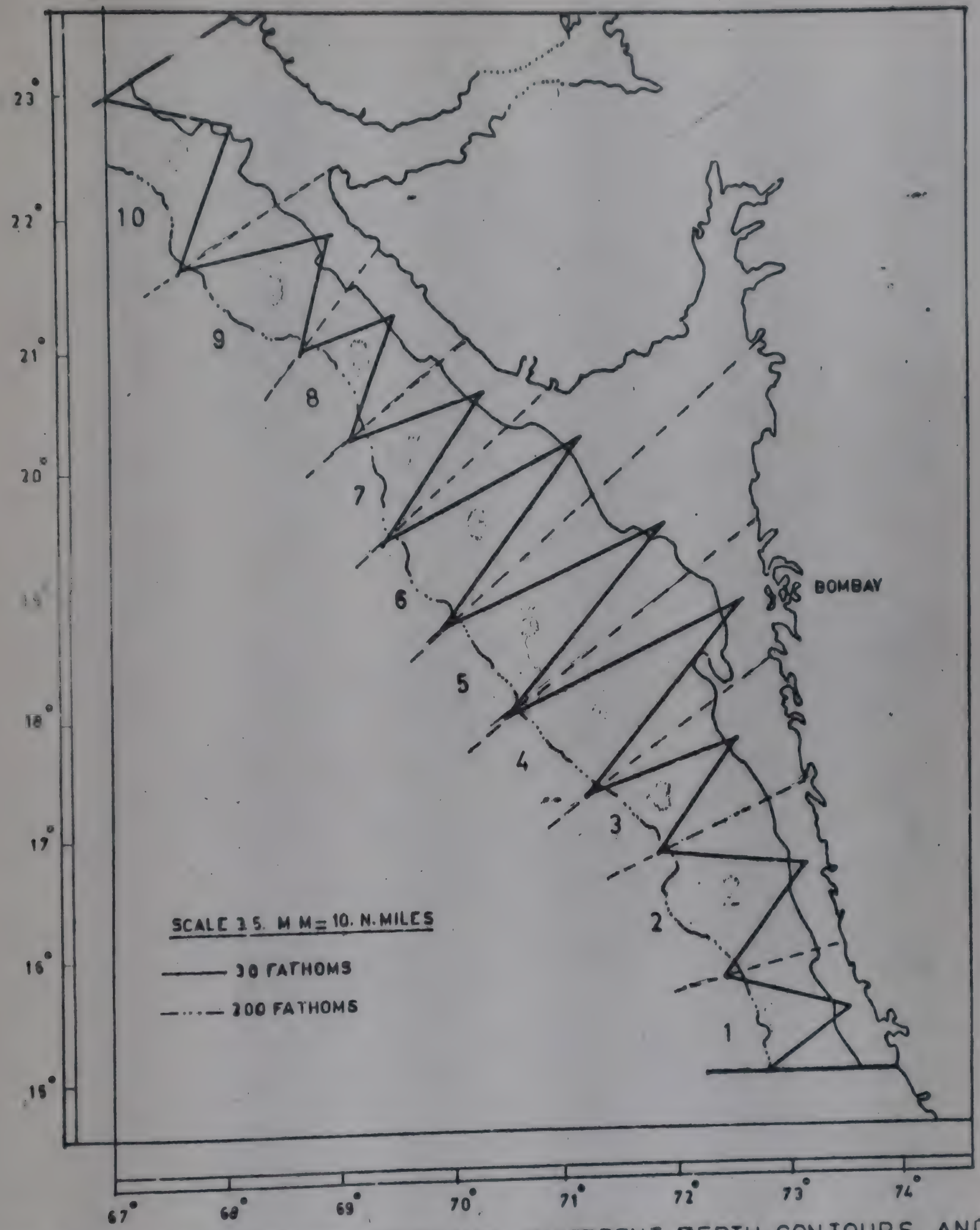


FIG. 2, AREA OF SURVEY SHOWING DIFFERENT DEPTH CONTOURS AND BASIC GRID OF PELAGIC FISH SURVEY BY M.T.MURENA

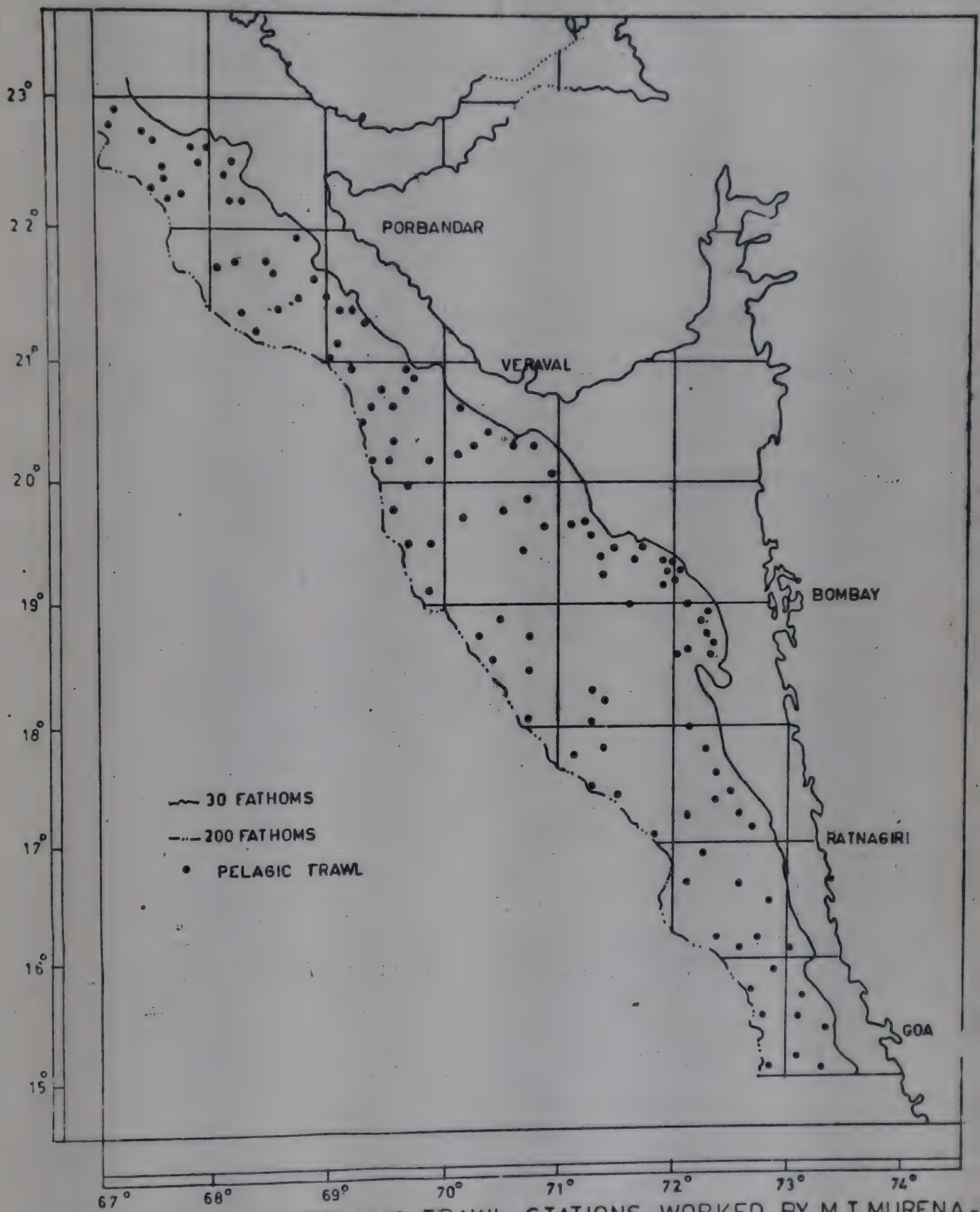


FIG.3. LOCATION OF PELAGIC TRAWL STATIONS WORKED BY M.T.MURENA - 4th CRUISE

The salinity, temperature and dissolved oxygen values were estimated at the surface, bottom and the mid-water layers along the 124 stations. Bottom sediments and plankton were collected at 32 and 54 stations respectively. Strata-wise break up on the number of observations made in respect of hydrography, bathythermograph casts, bottom sediments and plankton is presented in Table No.II.

Biological data on length, weight, sex, maturity and stomach contents were collected in respect of M. cordyla, T.haumela, A.thazard, P.argenteus, P.niger, S.guttatum, C.chrysophrys, D.russelli and O.argenteus and detailed work on these are in progress.

TABLE No. I Allocation of sampling effort in each of the ten zones and the work done during the fourth voyage of M.T.Murena

Zone	Area (Sq.km)	No.of obligatory hauls to be made	No.of hauls made	
			Exploratory survey	Intensive survey
1	2577	4	11	—
2	4292	4	11	—
3	3044	4	9	--
4	5718	4	13	3
5	5754	4	11	7
6	5133	4	11	--
7	3029	4	10	—
8	1813	4	13	—
9	3323	4	12	—
10	3384	4	16	—
TOTAL	38,067	40	117	10

TABLE No. II A zone-wise break up of the Oceanographic data collected during the fourth voyage of M.T.Murena

Zone	Number of observations made			
	Hydrology	Bathythermo-graph	Bottom sediments	Plankton collections
I	10	10	5	5
II	11	11	5	8
III	7	7	2	5
IV	15	15	1	9
V	18	18	3	13
VI	12	12	3	4
VII	10	10	3	-
VIII	12	12	4	-
IX	12	12	2	2
X	17	17	4	8
TOTAL	124	124	32	54

6. RESULTS OF OPERATION OF M.T. MURENA'S FOURTH VOYAGE

As stated earlier, the vessel conducted 43 days of pelagic trawling operations, expended 227.04 hours and landed a catch of 24,412 kg. The average catch/hour, catch/hour/h.p. and catch/day works out to 108 kg/hour, 0.07 kg and 568 kg respectively. Details of work done during the fourth voyage in respect of different depth ranges have been summed up in Table No.III. It is evident from the Table that the maximum effort put in was between 30 - 50 fathoms, next depth range heavily explored being 71-200 fathoms. The catch rates recorded at depth ranges between 30-50, 51-70 and 71-200 fathoms were 152.33 kg/hour, 2.71 kg/hour and 21.72 kg/hour respectively.

TABLE No. III Details of work carried out during M.T.Murena's fourth voyage

Depth range (fms)	No.of hauls made	Effort put in (hours)	Total catch (kg)	Catch/hour (kg)	Depth of fishing (m)
30 - 50	81	152.38	23,224	152.33	10 - 70
51 - 70	14	22.83	62	2.71	70 - 125
71 - 200	32	51.83	1,126	21.72	120 - 300
TOTAL	127	227.04	24,412	107.54	10 - 300

In this context, it might be of interest if data collected so far in respect of pelagic trawling for the different voyages is reviewed briefly. Keeping this in view, Table No.IV has been prepared giving details of effort put in, total catch landed, catch rates and catch/hour/h.p. for the four voyages undertaken by M.T.Murena.

TABLE No. IV Summary of results of pelagic trawling conducted by M.T.Murena during 1 - 4 voyages.

Voyage No.	No.of hauls	Fishing effort (hours)	Total catch (tons)	Catch/hour (Kg)	Catch/hour/h.p. (Kg)
I	29	65.13	17.2	263	0.16
II	121	284.19	237.1	834	0.51
III	64	157.74	87.0	551	0.34
IV	127	227.04	24.4	108	0.07
TOTAL	341	734.10	365.7	498	0.31

It may be seen that during the 3rd voyage (April/May, '77) the catch rate obtained was a little over half a ton, but on the contrary for the fourth cruise (June/August 1977) the catch rate obtained was very meagre (108 kg/hour) which requires careful consideration to find out the possible influence of any hydrographical factors prevailing in the area of operation during that part of the year which normally coincides with the north west monsoon. Comparing the data for all the four voyages, it is evident that the values obtained during the fourth voyage (June/August, '77) in respect of catch rate and catch/hour/h.p. was the lowest recorded.

Fishing details in respect of M.T.Murena's four voyages so far done are presented in Table No.V. It is seen that the vessel was out at sea for 154 days, expended 994.53 hours for a total catch of 422.14 tons at a catch rate of 424.5 kg/hour. The catch rates and catch/hour/h.p. recorded for pelagic and bottom trawling separately for all the voyages together are as follows:

Particulars	Fishing effort (hours)	Total catch (tons)	Catch/ hour(Kg)	Catch/ hour/h.p.(Kg)
Pelagic trawling	734.10	365.7	498	0.31
Bottom trawling	260.43	56.5	217	0.13

Further it was noticed that the values of catch rate and catch/hour/h.p. in respect of pelagic trawling was much higher than that of bottom trawling. However a correct analysis on the efficiency of the gears can be arrived at only after the conclusion of the sixth voyage, which will again be exclusively for pelagic trawling as per the agreement.

TABLE No. V Fishing details in respect of the four voyages so far done by M.T.Murena

Particulars	Cruise No.1	Cruise No.2	Cruise No.3	Cruise No.4	Total for all the four voyages
Fishing days	35	45	31	43	154
Fishing hours	215.25	313.92	238.32	227.04	994.53
Total catch (Kg)	48,130	2,42,493	1,07,103	24,412	4,22,138
Catch/hour (Kg)	223.6	772.5	449.4	107.5	424.5
Catch/hour/h.p.(Kg)	0.14	0.48	0.28	0.07	0.26
Catch/day (Kg)	1,375	5,389	3,445	568	2741

(i) Relative abundance by area

Table No. VI gives the area-wise total catch and catch rates obtained during the fourth voyage of M.T.Murena in respect of pelagic trawling. It is seen from the table that twenty areas were surveyed during the current voyage, the maximum effort was put in area 19-71 off Bombay (depth 30-50 fathoms) with 34.14 hours, the next best being 21-68 off Porbandar (depth 30-50 fathoms) with 21.00 hours. Areas 20-69 off Veraval (depth 30-70 fathoms) and 22-67 off Dwaraka (depth 30-50 fathoms) were surveyed by putting more than 15 hours of effort. In all the other areas surveyed, the effort put in was less than 15 hours.

While examining the catch rates obtained from the twenty areas, it is seen that the area 18-72 off Bombay (depth 30-50 fathoms) recorded the maximum catch rate with 849.5 Kg/hour, the next highest being from area 18-71 off Bombay (depth 30-50 fathoms)

with 304.4 kg/hour. The areas 19-71 off Bombay and 20-70 off Veraval also recorded appreciable catch rates of above 200 kg/hour. Further it was noticed that in all the other areas surveyed the catch rates obtained was less than 100 kg/hour. Data further illustrate the extremely poor yield from the areas off Goa and Ratnagiri during the current voyage undertaken by M.T.Murena.

TABLE No. VI Area-wise catch rate of pelagic trawling by M.T.Murena during fourth cruise (June/August, '77)

Area	Fishing effort (hours)	Total catch (kg)	Catch/hour (kg)
15-73	10.66	110	10.3
15-72	6.50	9	1.4
16-72	13.00	281	21.6
16-73	4.00	2	0.5
17-71	11.32	51	4.5
17-72	12.00	208	17.3
18-70	11.50	256	22.3
18-71	9.00	2740	304.4
18-72	8.50	7221	849.5
19-69	6.16	488	79.1
19-70	10.50	161	15.3
19-71	34.14	8198	240.1
19-72	3.66	448	122.4
20-69	19.32	229	11.5
20-70	10.16	2235	220.0
20-71	1.66	105	63.3
21-68	21.00	501	23.9
21-69	8.66	135	15.6
22-67	17.82	770	43.2
22-68	7.48	270	36.1
TOTAL	227.04	24,412	107.5

While comparing the data obtained by pelagic trawling during the third voyage, it was noticed that area 19-71 off Bombay (depth 30-50 fathoms) excelled with a catch rate of 895.43 kg/hour the bulk of the catch being horse mackerel, whereas for the current voyage the maximum catch rate (849.5 kg/hour) recorded was from 18-72 off Bombay (depth 30-50 fathoms), the bulk of landings constituted by ribbon fish, horse mackerel and elasmobranchs.

Table No. VII gives a consolidated picture of the area-wise fishing done, total catch landed and catch/hour obtained by M.T.Murena

TABLE No. VII Areawise catch, fishing effort and catch/hour obtained by M.T. MURENA by pelagic trawling during first to fourth cruises

Area	Fishing effort(hours)	Total catch(kg)	Catch/hour(kg)
15-72	8.33	42	5.0
15-73	18.41	3738	203.0
16-72	31.40	1772	56.4
16-73	4.00	2	0.5
17-71	17.23	377	21.9
17-72	16.42	571	34.8
18-70	19.33	752	38.9
18-71	15.66	3132	200.0
18-72	27.08	13029	481.1
19-69	12.07	7211	597.4
19-70	16.50	734	44.5
19-71	107.45	45659	508.7
19-72	13.99	3773	269.7
20-71	21.49	10893	506.9
20-70	60.47	22142	366.2
20-69	54.65	20772	380.1
21-69	34.08	6259	183.7
21-68	52.97	2205	41.6
21-67	1.33	40	30.1
22-67	144.79	177143	1223.4
22-68	46.04	33598	729.8
23-67	10.41	2738	263.0
TOTAL	734.10	3,56,582	485.7

during first to fourth voyages. Fig. 4 gives the catch rate obtained from different geographical divisions in respect of pelagic trawling based on the four voyages combined. The maximum effort viz. 144.79 hours was expended in area 22-67 off Dwaraka. The next intensively surveyed area was 19-71 off Bombay with 107.45 hours. It is seen that the area 22-67 off Dwaraka accounted for the highest catch rate viz. 1223.4 kg/hour. The second highest catch rate of 729.8 kg/hour was obtained from area 22-68 off Dwaraka. The areas 19-69, 19-71 and 20-71 yielded between 500-600 kg/hour. Fairly good catch rates ranging from 300-500 kg/hour were obtained from areas 18-72, 20-70 and 20-69. It may also be stated that fairly high catch rates recorded in certain areas along the North west coast of India are highly encouraging.

(ii) Region-wise catch composition

For convenience of analysis the area of investigation was divided into six regions viz. Goa, Ratnagiri, Bombay, Veraval, Porbandar and Dwaraka as was done in the earlier reports. The list of commercially important species with their local names occurring along the North west coast of India is given in Table No.VIII.

Table No. IX gives the catch rate of important species obtained from the six geographical regions during the fourth cruise. It can be seen that about 37% of the fishing effort was expended in Bombay region and 80% of the catch was also landed from this region. The percentage of fishing effort expended in other regions in the order were, Ratnagiri 18%, Veraval 14%, Porbandar 13%, Dwaraka 10% and Goa 8%. It was also noticed that about 10.5% of the total catch was obtained from Veraval, Dwaraka accounted for 4.3%, Porbandar 2.6%, Ratnagiri 2.2% and Goa 0.5%. Bombay region yielded the highest catch/hour with 234 kg/hour, Veraval occupied the next place with a catch rate of 82 kg/hour, Dwaraka with 41 kg/hour, Porbandar with 21 kg/hour. Goa and Ratnagiri regions were extremely poor with catch rates at 7 kg/hour and 13 kg/hour respectively.

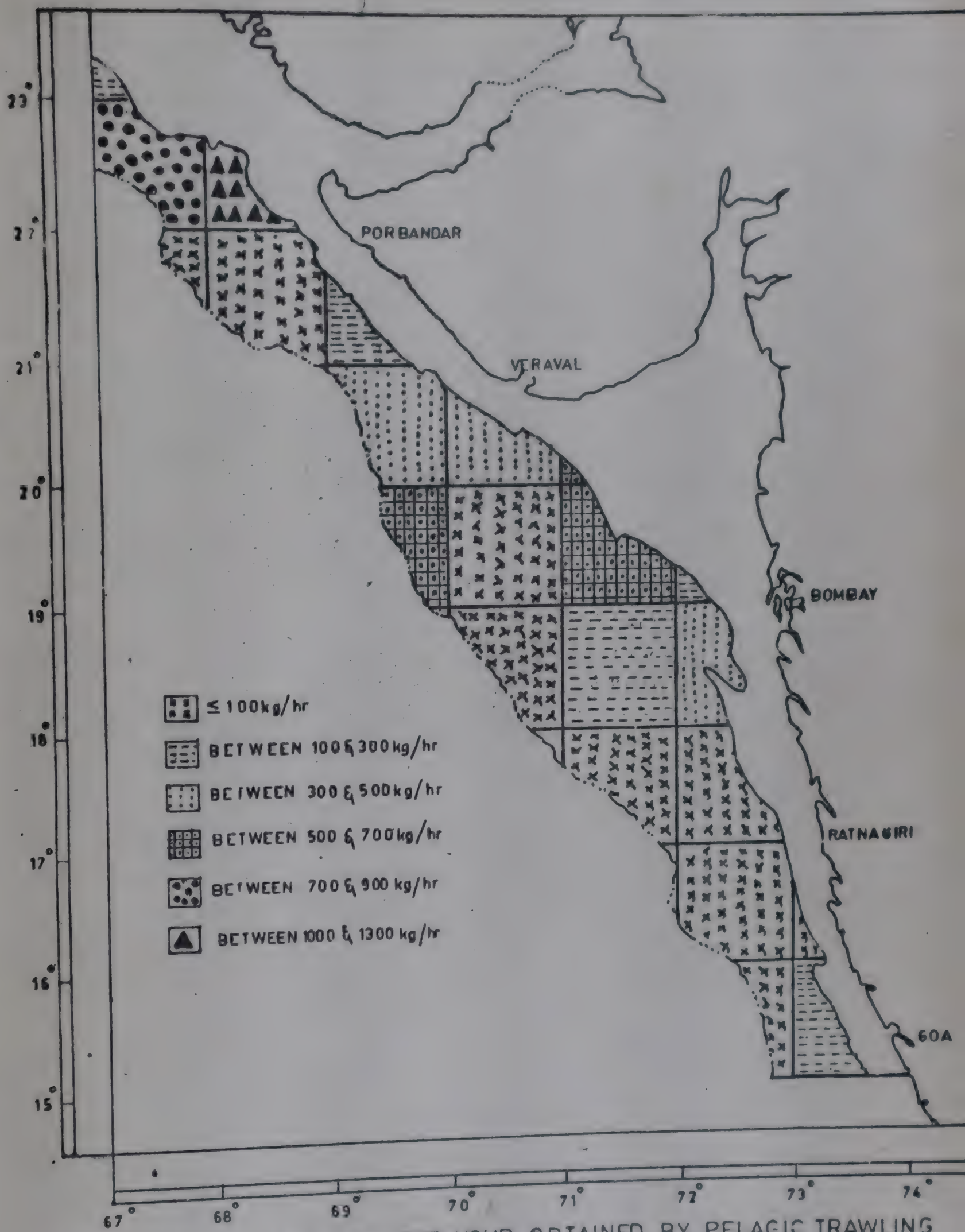


FIG 4 AREA-WISE CATCH PER HOUR OBTAINED BY PELAGIC TRAWLING DURING 1st TO 4th CRUISE OF M.T. MURENA

TABIE No. VIII List of commercially important species with their local names occurring along the North west coast of India

Scientific name	Common English name	Local name
Scoliodon spp.	Shark	Mushi
Pristis spp.	Saw fish	Mali
Trygon and Raja spp.	Sting ray	Pakat
Anchoviella spp.	Anchovy	Kati
Chirocentrus dorab	Dorab	Karli
Trachysurus spp.	Cat fish	Shingada
Epinephelus spp.	Reef cod	Gobra
Lactarius lactarius	Butter fish	Pervi
Megalaspis cordyla	Horse mackerel	Karkatu Bangada
Caranx spp.	Trevelly	Kala Bangada
Chorinemus spp.	Leather skin	Dagol
Mene maculata	Moon fish	Chand
Lutianus argentimaculatus	Red snapper	Tambusa
Nemipterus japonicus	Thread fin bream	Rani fish
Leiognathus spp.	Silver belly	Khapi
Pomadasys maculatus	Spotted grunters	Karkara
Trichiurus spp.	Ribbon fish	Wakti
Rastrelliger kanagurta	Mackerel	Bangada
Parastromateus niger	Black pomfret	Halva
Pampus argenteus	Silver pomfret	Saranga, Paplet
Saurida tumbil	Lizard fish	Chor-bombil
Muraenosox spp.	Eel	Wam
Pseudosciaenia spp.	Jew fish	Ghol
Johnius spp.	Croaker	Dhoma
Otolithoides spp.	Dori	Koth
Pellona spp.	White Bail	Kati

TABLE NO. IX Regionwise catch rates obtained by Pelagic trawling by M.T.Murena during the fourth cruise

Varieties	Goa	Ratnagiri	Bombay	Veraval	Porbandar	Dwaraka
Shark/Skate	2.0	5.0	16.8	11.3	4.6	3.2
Rays	-	0.1	4.3	3.2	2.8	0.4
Ribbon fish	0.9	0.8	36.5	43.0	0.3	24.8
Cat fish	0.6	0.2	4.2	3.0	-	0.2
Dhoma	-	-	2.7	3.2	-	0.1
Horse mackerel	0.1	1.6	16.6	2.9	-	-
Ghol	-	-	5.0	2.6	-	-
Perch	-	-	5.2	1.3	-	-
Pomfret	-	-	10.5	2.7	-	0.5
Eel	-	-	0.3	0.3	-	-
Karkara	-	-	0.3	-	-	0.1
Caranx spp.	0.2	0.1	32.4	0.7	0.2	1.2
Tuna	-	-	5.8	-	9.6	7.2
Surmai	-	0.2	10.9	3.2	0.6	0.1
Chorinemus sp.	-	-	-	1.3	-	-
Chirocentrus sp.	-	-	0.1	0.9	-	-
Barracuda	-	0.1	0.5	0.2	0.5	0.7
Squid	0.1	-	0.1	-	-	1.7
Prawn	-	-	0.1	-	-	0.5
Others	3.0	5.1	90.7	2.6	2.9	0.5
Total catch (Kg)	119	542	19511	2563	636	1040
Fishing effort(hrs)	17.16	40.32	83.46	31.14	29.66	25.30
Catch/hour (kg)	6.9	13.2	233.9	82.4	21.4	41.2

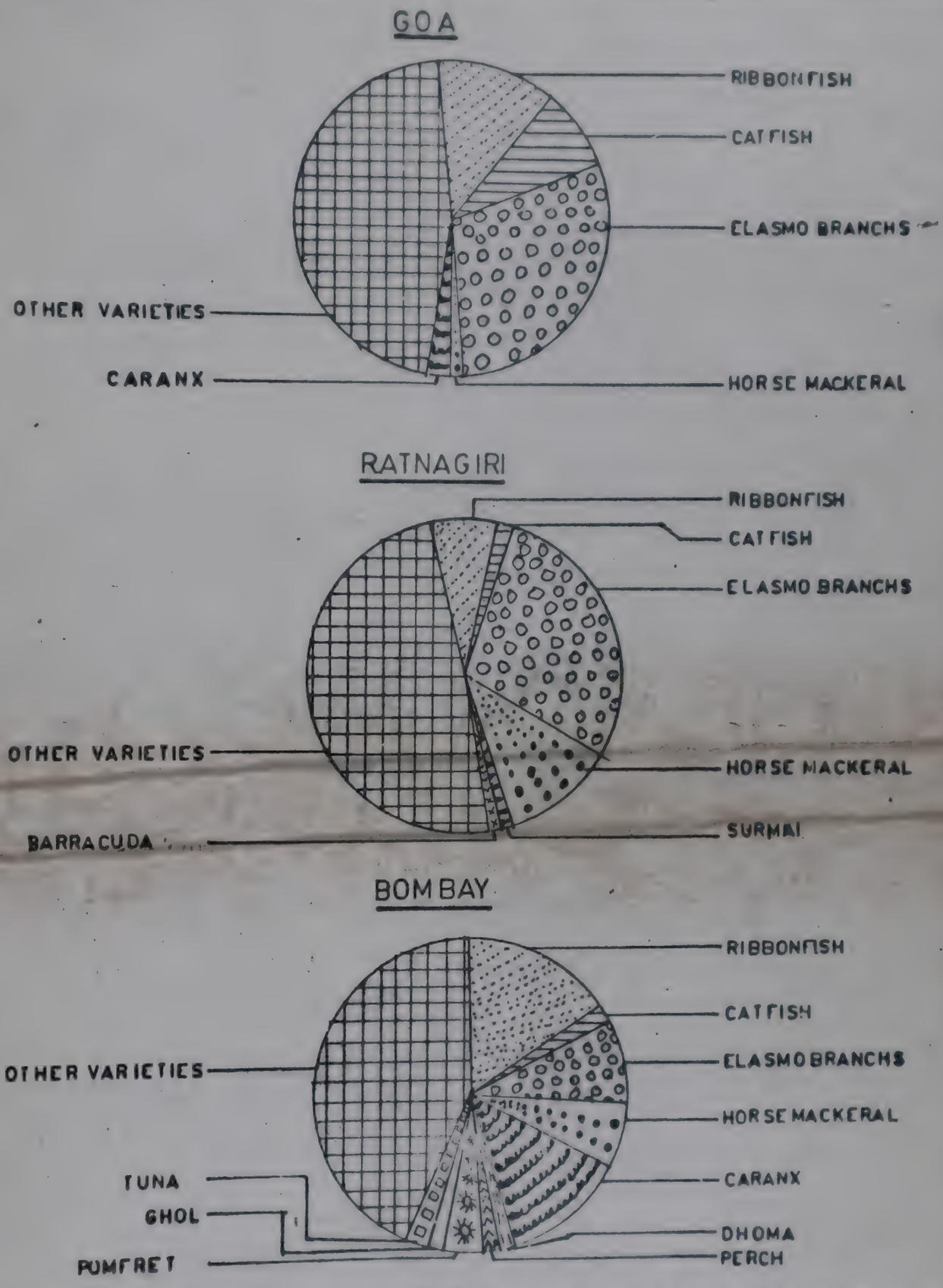
A comparative study of the region-wise catch rates obtained by pelagic trawling during M.T.Murena's third voyage (April/May, 1977) with that of the current voyage (June/August, 1977) will be of interest (Table No. X).

TABLE No. X Summary of region-wise catch details in respect of third and fourth voyages of M.T.Murena

Particulars		Goa	Ratnagiri	Bombay	Veraval	Porbandar	Dwaraka
Third voyage							
Total catch	(Kg)	-	-	44,625	26,642	2,272	13,426
Effort	(hrs)	-	-	65.49	44.50	20.84	26.91
Catch/hour	(Kg)	-	-	681.42	598.67	109.93	498.89
Catch/hour/h.p.	(Kg)	-	-	0.42	0.37	0.07	0.31
Fourth voyage							
Total catch	(Kg)	119	542	19,511	2,563	636	1040
Effort	(hrs)	17.16	40.32	83.46	31.14	29.66	24.30
Catch/hour	(Kg)	6.9	13.2	233.9	82.4	21.4	41.2
Catch/hour/h.p.	(Kg)	-	-	-	-	-	-

The trend of distribution of catch rates recorded were more or less same for both the voyages, Bombay netting the highest catch rate, followed by Veraval, Dwaraka and Porbandar. Goa and Ratnagiri recorded comparatively poor catch rates for the fourth voyage, whereas for the third voyage due to lack of concentration of fish schools no attempts of pelagic trawling was done and further the third voyage was primarily for bottom trawling investigation.

Catch composition of pelagic trawling by M.T.Murena's fourth cruise from the different geographical regions are presented in Figs.5 and 6.



FIG,5. CATCH COMPOSITION BY PELAGIC TRAWLING DURING M.T.MURENAS 4th VOYAGE OFF GOA, RATNAGIRI AND BOMBAY.

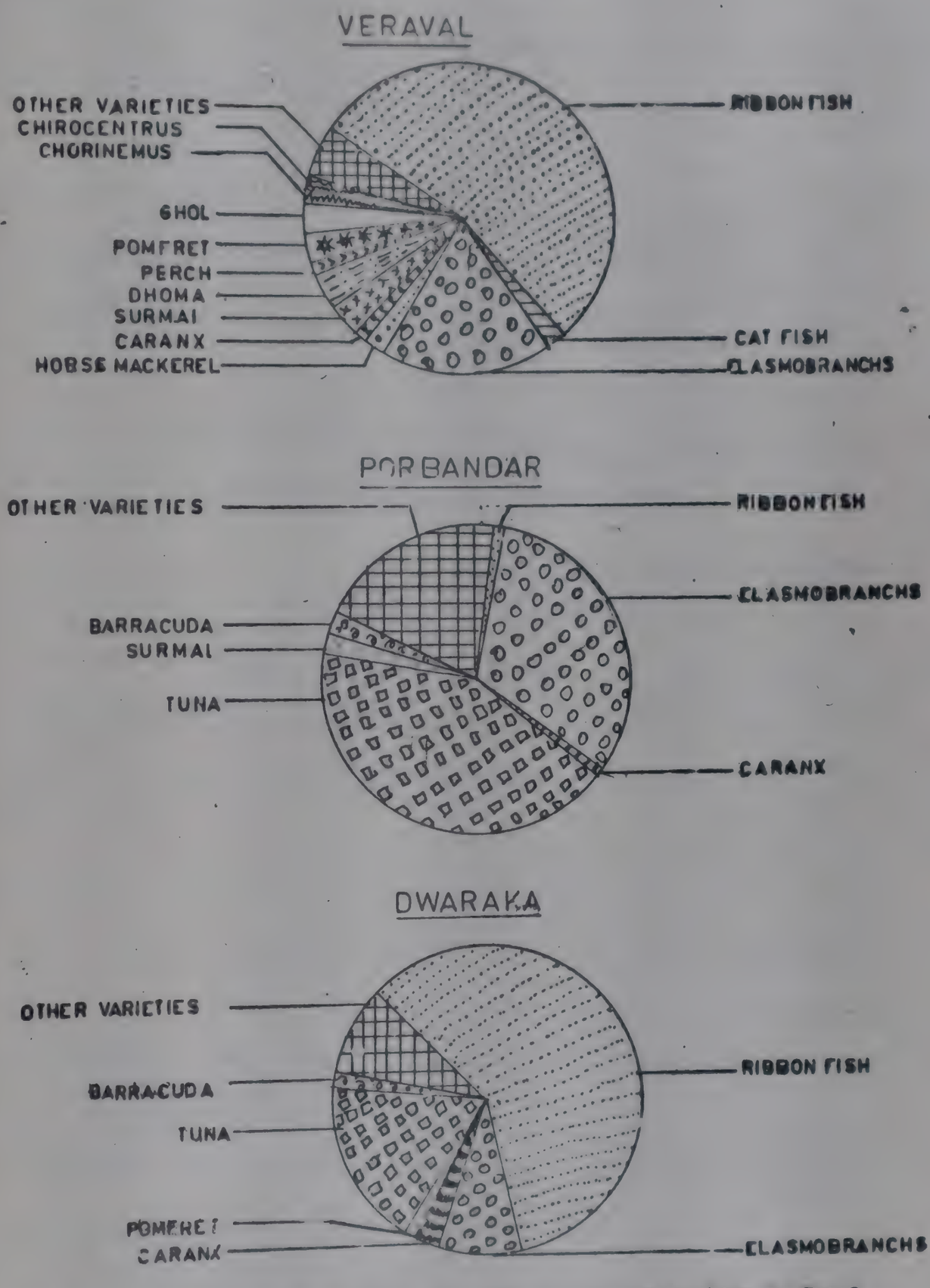


FIG 5 CATCH COMPOSITION BY PELAGIC TRAWLING DURING M. T. MURENA'S 4th VOYAGE OFF VERAVAL, PORBANDAR AND DWARAKA.

Table No. XI gives the catch composition, catch/hour and the percentage composition of important varieties of fish obtained by pelagic trawling during M.T.Murena's fourth voyage. It can be seen that ribbon fish accounted for about 21% of the total catch, Caranx sp. contributed about 11% and elasmobranchs 12%. The catch rates obtained for ribbon fish, Caranx sp. and elasmobranchs for the current voyage works out to 22.3 kg/hour, 12.2 kg/hour and 12 kg/hour respectively. Horse mackerel and eel were found predominant next to ribbon fish during the third voyage but comparatively poor quantities of these varieties were netted during the current voyage.

An analysis of catch composition recorded from Zone I to Zone X as indicated in the pelagic survey grid, has revealed certain interesting features. Table XII shows the catch per hour of important species netted during the fourth voyage in respect of different zones.

Though the highest catch rate of 423 kg/hour was recorded from zone IV off Bombay, it is seen that more than 70% of the catch was constituted by trigger fish (Odonus niger). It was further observed that from a single haul in area 18-72 at fishing depth of 40 m about 7 tons of this variety was caught. Next dominant group in zone IV Caranx chrysophrys. It is seen from a single haul off Bombay in area 18-72 large quantities of this species was netted giving a catch rate of 115.21 kg/hour. For ribbon fish, T. haumela the highest catch rate was recorded from region VI off Gulf of Cambay with 31.21 kg/hour, next was from region X off Takhaval with 24.33 kg/hour. For elasmobranchs, in zones V and VI, the catch rates varied from 14-18 kg/hour.

TABLE No. XI The catch composition, catch rates and percentage of each variety in the total catch obtained by Pelagic trawling by M.T.Murena during the fourth cruise

Varieties	Total catch (kg)	Percentage	Catch/hour (kg)
Shark/Skates	2209	9.0	9.7
Rays	557	2.3	2.5
Ribbon fish	5070	20.8	22.3
Cat fish	464	1.9	2.0
Dhoma	327	1.3	1.4
Horse mackerel	1548	6.3	6.8
Ghol	506	2.1	2.2
Perch	471	1.9	2.1
Pomfret	973	4.0	4.3
Eel	32	0.1	0.1
Karkara	26	0.1	0.1
Caranx spp	2764	11.3	12.2
Tuna	956	3.9	4.2
Surmai	202	0.8	0.9
Chorinemus sp.	39	0.2	0.2
Chirocentrus sp.	32	0.1	0.1
Barracuda	85	0.3	0.4
Squid	53	0.2	0.2
Prawn	92	0.4	0.4
Others	8006	32.8	35.4
TOTAL	24,412	100.0	107.5

TABLE NO. XII Zone-wise catch per hour (kg) of important species netted during the fourth voyage of M.T.Murena

Species	Zones									
	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Elasmobranch	1.82	10.51	-	3.41	18.58	14.26	8.93	5.28	9.08	3.58
2. Ribbon fish	0.75	0.15	2.09	3.00	13.57	31.21	38.59	0.15	0.76	24.33
3. Horse mackerel	0.10	0.05	4.55	1.36	6.81	5.70	1.06	-	-	-
4. Pomfret	-	-	-	0.17	5.55	3.57	0.50	-	0.05	0.46
5. Cat fish	0.50	-	0.63	-	-	2.57	1.56	0.51	-	0.18
6. Seer fish	-	-	0.40	0.21	1.03	4.19	0.63	0.37	0.45	0.14
7. Tuna	0.30	-	-	0.83	0.44	21.66	0.05	0.42	13.87	7.03
8. Sucker fish	0.30	0.59	0.87	0.21	0.27	0.25	0.17	0.16	0.17	0.15
9. Dhoma	-	-	-	-	-	-	5.58	-	-	0.08
10. Ghol	-	-	-	-	3.81	0.76	3.82	-	-	-
11. Clupeids	-	-	-	0.04	0.04	1.38	-	-	0.01	0.15
12. Red snapper	-	-	0.02	0.94	9.79	-	2.05	-	-	-
13. Chorinemus sp.	-	-	0.02	-	-	0.71	1.35	-	0.01	-
14. Caranx spp	0.15	0.10	-	115.21	0.58	0.08	1.31	-	0.11	1.16
15. Barracuda	-	0.31	0.10	0.78	0.67	0.14	0.05	0.33	0.45	0.63
16. Odonus niger	0.05	2.56	8.37	298.02	-	-	-	-	-	-
17. Shrimps	-	-	-	-	-	-	-	-	-	0.46
18. Cephalopods	0.16	0.05	0.03	-	-	-	-	0.05	-	1.56
19. Sail fish	2.01	-	-	-	2.01	2.38	-	1.39	-	-
20. Mene maculata	0.01	0.05	-	-	-	0.05	0.77	1.74	0.04	0.04
21. Others	0.16	0.23	0.09	0.10	0.65	0.81	-	2.12	0.29	0.24
TOTAL	6.00	14.56	17.18	423.29	61.81	89.70	66.46	12.53	25.23	40.17

The occurrence of juvenile tuna and frigate mackerel in the trawl catches is of special interest. Tuna formed about 4% of the total catch with a catch rate of 4.62 kg/hour. They represented in all the areas except zone II (off Ratnagiri) and zone III (off Srivardhan). The main species caught were frigate mackerel (Auxis thazard) which were accounted for from the zone off Gulf of Cambay (Stratum 18, Zone VI) and off Dwaraka (Stratum 27, Zone IX) from fishing depth of 20-25 m. Besides A.thazard, other varieties netted were E.affinis and T.tonggol caught mostly from zone X (stratum 28) at fishing depth of 35 m. The occurrence of juvenile tuna in this region is particularly significant as it is suggestive of a commercially important variety in the near vicinity. However, further investigations are necessary in this region to arrive at any definite conclusions.

Horse mackerel which formed the bulk of the pelagic trawl catches in the earlier cruises accounted for 6.3% of the catch at a rate of 6.8 kg/hour during the current voyage. Though they were recorded in smaller quantities in zones I - VII, comparatively better catch rates were obtained off Dahanu (6.81 kg/hour) and Srivardhan (5.70 kg/hour). Sciaenids, mostly P. diacanthus, O. argenteus were frequently caught off Veraval and Dahanu.

(iii) Notes on hydrographical and meteorological observations

Hydrology: It was observed that in general, higher surface temperature ranging from 27.4°C to 29.6°C, 27.6°C to 29.8°C and 27.6° to 29.5°C in 30-50 fathoms, 51-70 fathoms and 71-200 fathoms respectively was noticed south of Tarapur i.e. zone I to V. On the other hand, higher surface salinity values ranging from 36.26 to 37.56‰ in 30-50 fathoms, 36.36 to 37.48‰ in 51-70 fathoms and 36.44 to 37.34‰ in 71-200 fathoms was recorded. Further, it was noticed that higher surface oxygen values (4.99 to 8.82 ml/L in 30-50 fathoms, 4.67 to 6.87 ml/L in 51-70 fathoms and 5.32 to 6.68 ml/L in 71-200 fathoms) were also noticed off Bombay.

Further it was observed that off Goa-Ratnagiri and Srivardhan waters, relatively low salinity (34.44 to 36.09‰) was seen spreading upto 70 fathoms. It is of interest to note that in the region off Dwaraka (lat. 22°34' N - 22°57' N and long. 67°E - 68°15'E) waters of low temperatures (26.3° C to 27.1°C), low salinities and with high oxygen content (7.17 to 8.82 ml/L) were observed. These findings are of special interest, especially when the fish concentrations available during this part of the year along the North west coast of India was very meagre.

On a detailed examination of the Oceanographic parameters like temperature, salinity and oxygen at different depths recorded during the fourth voyage, it is evident that the area of investigation had a large zone of low oxygen waters especially during the monsoon period. Table No.XIII gives the

distribution of oxygen (ml/L) along the shelf during June, '77. The stations where the occurrence of oxygen was less than 1 ml/L at depths more than 80 m have been shown in the Table. The occurrence of low oxygen in deeper regions in the Arabian Sea during monsoon months have been reported earlier by the International Indian Ocean Expedition. It is needless to point out that the movement of the low oxygen water layer influences fish migration, distribution and disappearance of fishes in the fishing grounds to a great extent. The absence of fish concentrations in the area of present investigation during the current voyage is highly significant but to establish correlations between any of the Oceanographic parameters requires more detailed studies over a continuous period. The data collected is being processed in detail and will be presented elsewhere.

Meteorology: From the beginning of the voyage till the first week of August, 1977 the weather was marked by strong winds (maximum speed 34 knots) with occasional falls; low pressure (1001 - 1005 mb) overcast sky, rough sea and sometimes bad visibility. During the second week of August, the weather was better with relatively low wind speed (8 knots), high pressure upto 1013 mb, clouds covering 75% of the sky, calm sea and good visibility.

TABLE NO. XIII

Distribution of temperature and oxygen at different depths along the shelf area during June '77

Stations	Position Lat./Long.	Depth (Metres)	Temperature (0° C)	Oxygen (ml/L)
1	$17^{\circ}46'$ N	0	29.51	5.03
		40	29.61	5.33
	$7^{\circ}{}^{\circ}23'$ E	160	16.80	0.55
8	$16^{\circ}06'$ N	0	29.10	5.57
	$72^{\circ}29'$ N	30	29.09	5.49
		170	16.53	0.20
10	$15^{\circ}38'$ N	0	28.99	5.76
	$72^{\circ}56'$ N	30	29.01	5.58
		100	20.02	0.56
12	$15^{\circ}53'$ N	0	28.99	5.74
	$13^{\circ}04'$ E	25	29.00	5.63
		75	21.69	1.22
13	$16^{\circ}33'$ N	0	29.00	5.42
	$72^{\circ}58'$ E	55	23.63	2.35
14	$17^{\circ}29'$ N	0	29.24	5.45
	$72^{\circ}58'$ E	20	29.30	5.36
		70	26.56	3.90
20	$18^{\circ}47'$ N	0	29.15	5.60
	$70^{\circ}24'$ E	60	29.14	5.47
		130	17.91	0.36
22	$18^{\circ}55'$ N	0	29.07	6.58
	$70^{\circ}24'$ E	40	28.72	5.62
		85	21.12	1.67
24	$19^{\circ}31'$ N	0	29.26	5.66
	$69^{\circ}58'$ E	40	29.24	5.57
		85	20.59	1.63
27	$19^{\circ}54'$ N	0	29.19	5.79
	$70^{\circ}49'$ E	35	29.21	5.70
		65	25.54	2.66
32	$20^{\circ}14'$ N	0	29.20	5.69
	$60^{\circ}24'$ E	50	29.24	5.67
		150	17.84	0.93
33	$20^{\circ}26'$ N	0	29.06	5.40
	$69^{\circ}24'$ E	30	29.08	5.42
		80	23.01	2.55
34	$20^{\circ}36'$ N	0	29.22	5.57
	$69^{\circ}16'$ E	100	23.12	3.52
		190	16.83	0.58

7. SUMMARY

M.T. Murena during her fourth voyage lasting for forty three days conducted 127 pelagic trawl hauls, expended 227.04 hours, landed a catch of 24,412 Kg. The average catch/hour, catch/hour/h.p. and catch/day works out to 108 kg/hour, 0.07 kg and 568 kg respectively. The catch rates recorded at depth ranges between 30-50, 51-70 and 71-200 fathoms were 152.33 kg/hour, 2.7 kg/hour and 21.72 kg/hour respectively.

Combining all the four voyages undertaken by M.T.Murena, it is seen that the vessel was out at sea for 154 days, expended 994.53 hours, for a total catch of 422.14 tons at a catch rate of 424.5 kg/hour. The catch rates recorded for pelagic and bottom trawling works out to 498 kg/hour and 217 kg/hour respectively.

Based on the fourth voyage, it is seen that twenty areas were surveyed and out of this, the maximum catch rate was recorded from 18-72 off Bombay with 849.5 kg/hour, the next highest being from 18-71 off Bombay with 304.4 kg/hour. The areas 19-71 off Bombay and 20-70 off Veraval also recorded appreciable catch rates of above 200 kg/hour. Data further illustrates the extremely poor yield from the areas off Goa and Ratnagiri.

The areawise catch rate in respect of pelagic trawling obtained during first to fourth voyages was studied in detail. It is seen that the area 22-67 off Dwaraka accounted for the highest catch rate with 1223.4 kg/hour, the

the second highest being from area 22-68 off Dwaraka with 729.8 kg/hour. The areas 19-69, 19-71 and 20-71 yielded between 500-600 kg/hour. Comparatively good catch rates ranging from 300-500 kg/hour were obtained from areas 18-72, 20-70 and 20-69.

Region-wise catch composition in respect of the fourth voyage was studied in detail as was done in the earlier voyages. Bombay region yielded the highest catch rate with 234 kg/hour, Veraval occupied the next place with 82 kg/hour. The trend of distribution of catch rates for the fourth voyage were more or less the same as was obtained for the third cruise in respect of pelagic trawling, Bombay netting the highest, followed by Veraval, Dwaraka and Porbandar.

An analysis of catch composition recorded from Zones I to X as indicated in the pelagic survey grid has been presented and some interesting observations made known.

The occurrence of juvenile tuna and frigate mackerel in Zone VI (off Gulf of Cambay) and in Zone IX (off Dwaraka) was of special interest which is suggestive of a commercially important variety in the near vicinity.

Brief notes on hydrographical and meteorological observations made during the fourth voyage are presented. Certain phenomenon on the occurrence of low O_2 waters will have to be studied in detail especially to assess the reasons for the poor recordings of fish schools in the regions from 30-200 fathoms along the North west coast of India during this part of the year.

BULLETINS/REPORTS RELEASED BY THE EXPLORATORY FISHERIES PROJECT

Bulletin No.1 November, '74	Demersal fisheries resources off the North west coast of India By K.M.Joseph
Bulletin No.2 July, '75	Annual report - 1974-75
Bulletin No.3 March, '76	Demersal fisheries resources off the South west coast of India By K.M.Joseph, Radhakrishnan N. and Philip K.P.
Bulletin No.4 June, '76	Results of exploratory fishing conducted during 1975-76
Bulletin No.5 September, '76	Results of demersal fisheries resources survey along the East coast of India 1959-74 By K.M. Joseph, Radhakrishnan N. Antony Joseph and Philip K.P.
Report No.1 April, '77	Preliminary report of the first cruise of M.T.Murena (8th January to 10th February, '77) and supporting vessels By S.N.Dwivedi, Radhakrishnan N. and Philip K.P.
Report No.2 May, '77	Preliminary report of the second cruise of M.T.Murena and supporting vessels for the period from 19th February to 12th April '77 By S.N.Dwivedi, Radhakrishnan N. Vijayakumaran K. and Nair M.K.R.
Report No.3 August, '77	Part I. Preliminary report of the third cruise of M.T.Murena and supporting vessels for the period from 21st April to 21st May, 1977 By S.N.Dwivedi, Radhakrishnan N. Sulochanan P., Nair M.K.R. and Antony Joseph Part II. Economics and feasibility studies on the operation of a 69 m factory trawler in India By S.K.Bhadury, Nair M.K.R. and Antony Joseph

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